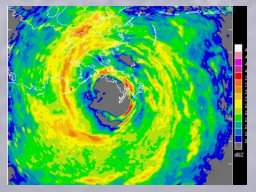
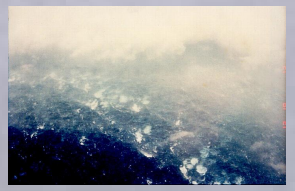
Hurricane Impacts


Mark Powell
AOML Program Review
18-20 March 2008

Key Questions

- *How can we adaptively observe and integrate diverse measurements to determine the magnitude and extent of hurricane wind, surge, wave, and rain events?*
- *How do air-sea momentum forcing and enthalpy flux properties vary within a hurricane, in open ocean, and near the coast?*
- *Hurricanes are episodic events with ecosystem and climate change ramifications. How can we best support our NOAA and university partners in this mission area?*
- *How does hurricane risk vary across the State of Florida and what are the characteristics of "worst case" events?*

Impacts Outline

Integrated and adaptive observations / tools

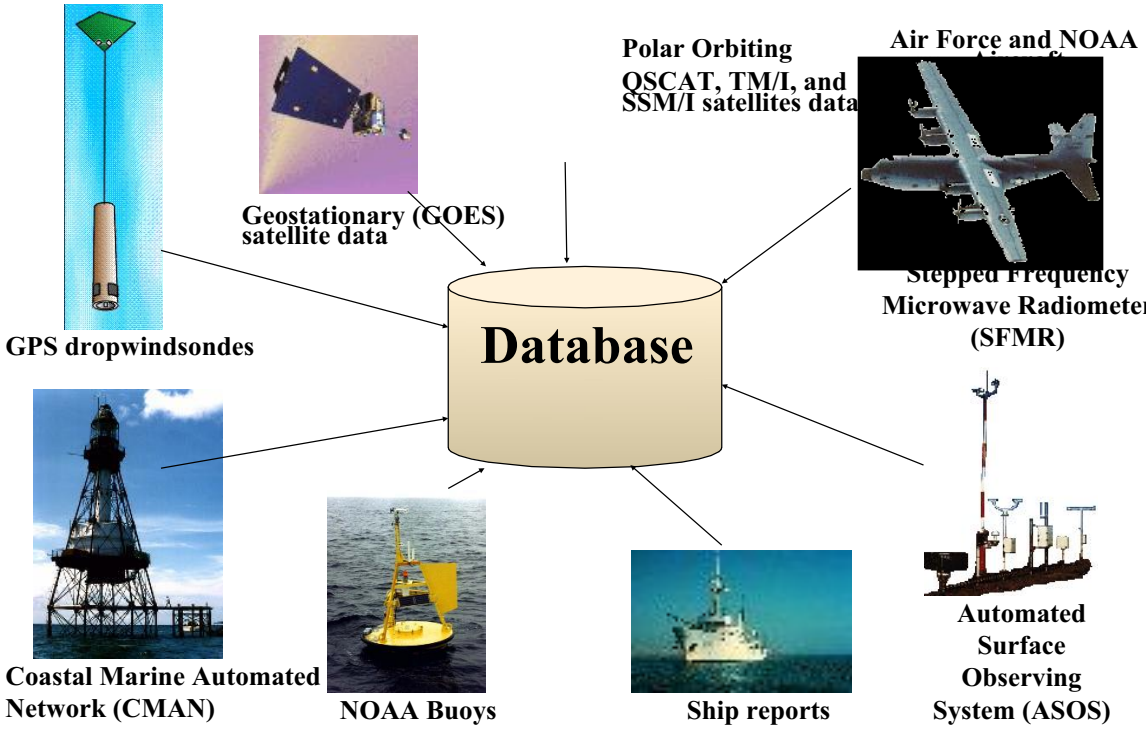
Winds, waves, and storm surge

Ecosystems and Climate

Rainfall flooding

Hurricane Risk

Integrated observations



Tropical cyclone observations from space, sea, land, and air

Adaptive observations from aircraft and portable land-based sensors

Partnerships with public and private sectors

Adaptive Observing network

NOAA and Air Force Aircraft,

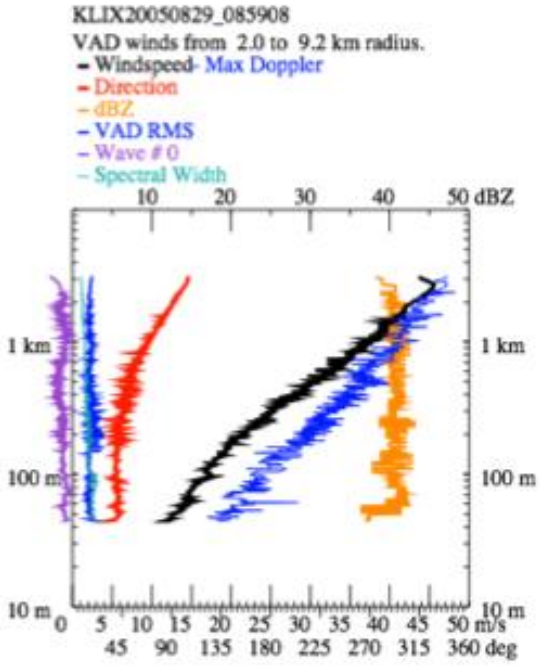
US Hurricane Landfall Coastal Network (TTU, UF, LSU, Clemson)

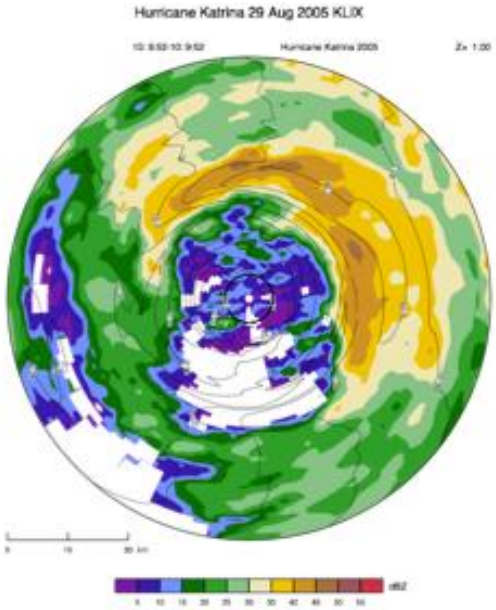
WeatherFlow
Managed Weather Networks & Solutions

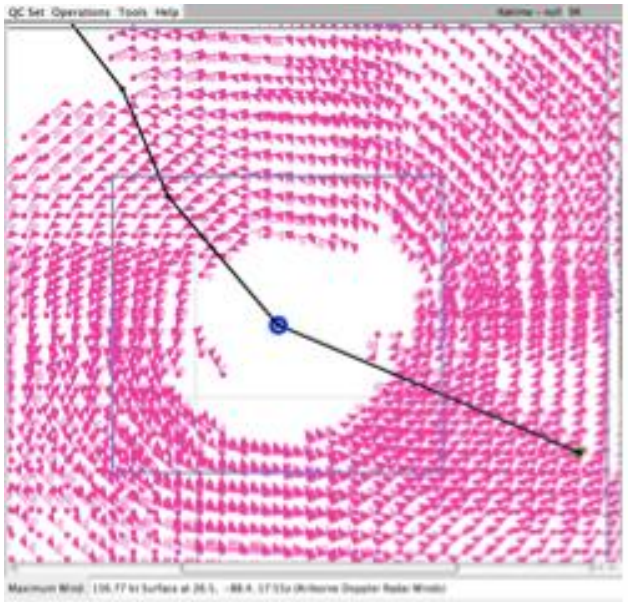
Scientists: HRD Field Program

Doppler Radars

- Land-based radars and GBVTD
- Airborne radars for DA and RTMA
- Post landfall event reconstruction







Scientists: Gamache, Murillo, Dodge

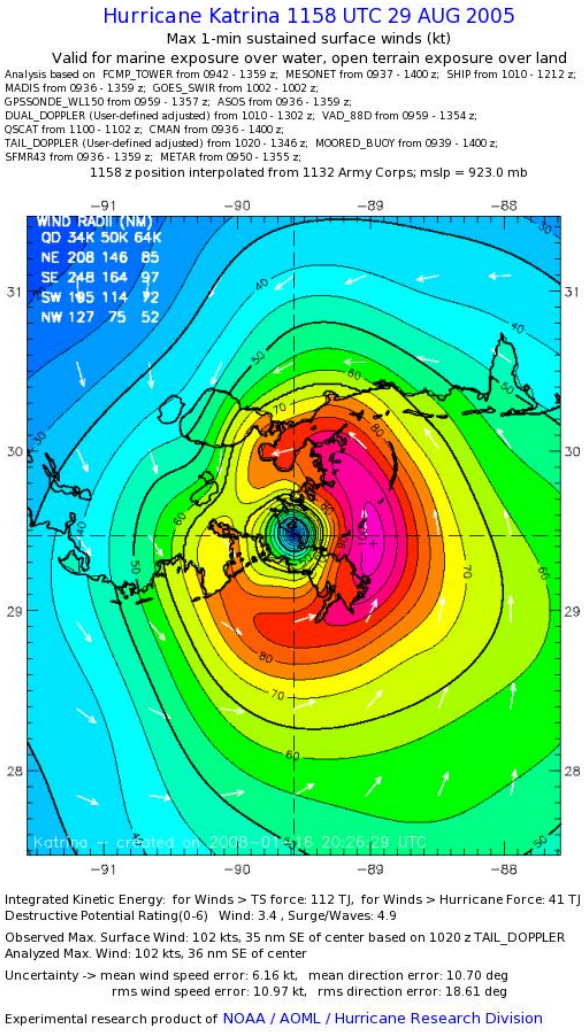
H*Wind

Scientists interact with observations to produce a real-time mesoscale analysis

Record of the event, disaster response

Basis for evaluating model performance (NASA Goddard, GFDL, NCAR)

Scientists: Powell, Murillo, Annane, Otero, Carrasco



Winds, Waves, Surge

Wind field surface stress forces the waves and surge

Establish the surface friction thru GPS sonde research

Gridded wind fields help drive surge, wave, damage models

Alternative measures of the storm impact to improve warning process and evaluate models

Scientists: Powell, St. Fleur, Otero, Zhang

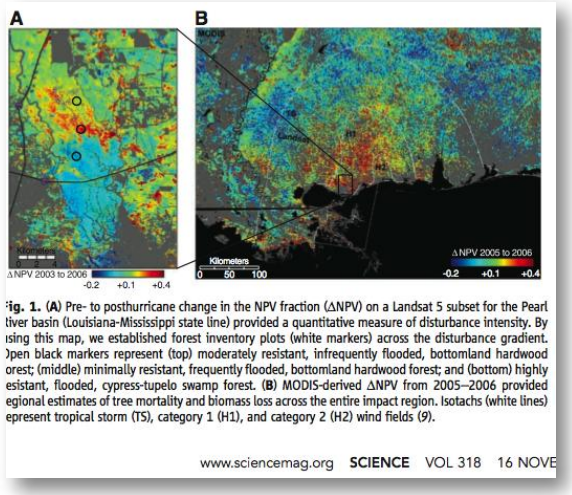


Fig. 1. (**A**) Pre- to posthurricane change in the NPV fraction (ΔNPV) on a Landsat 5 subset for the Pearl River basin (Louisiana-Mississippi state line) provided a quantitative measure of disturbance intensity. By using this map, we established forest inventory plots (white markers) across the disturbance gradient. Open black markers represent (top) moderately resistant, infrequently flooded, bottomland hardwood forest; (middle) minimally resistant, frequently flooded, bottomland hardwood forest; and (bottom) highly resistant, flooded, cypress-tupelo swamp forest. (**B**) MODIS-derived ΔNPV from 2005–2006 provided regional estimates of tree mortality and biomass loss across the entire impact region. Isotachs (white lines) represent tropical storm (TS), category 1 (H1), and category 2 (H2) wind fields (9).

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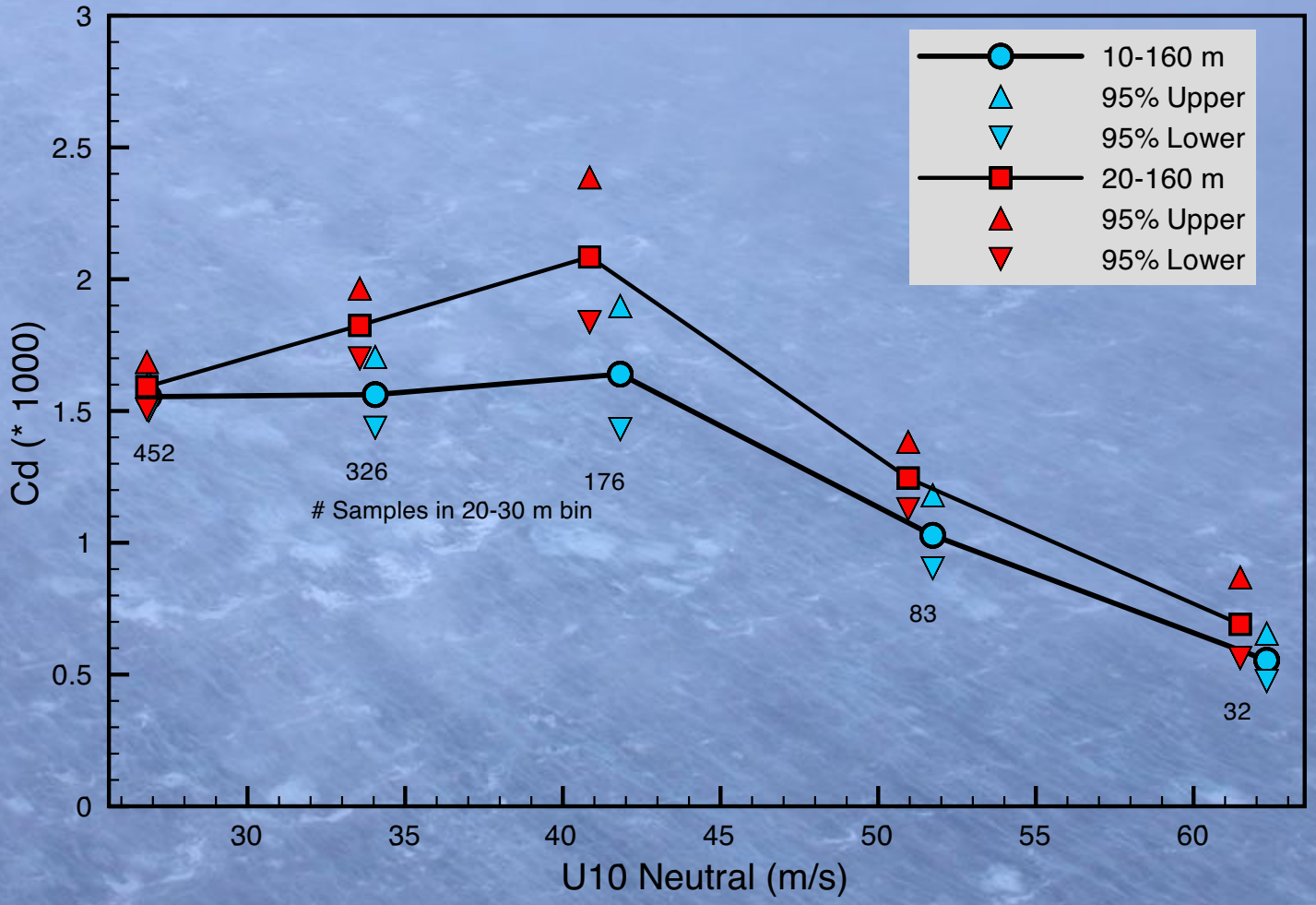
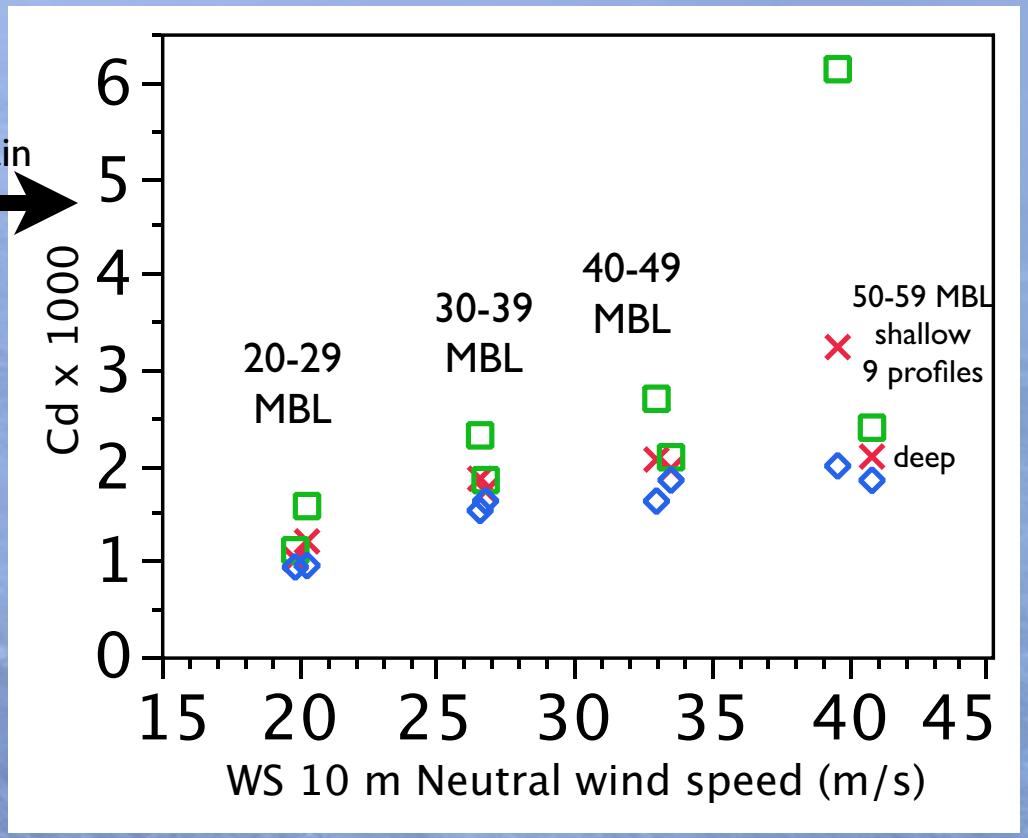
Drag Coefficient Behavior in Hurricanes

20-160 m surface layer



Cd in Shallow and deep water



No significant differences between shallow and deep water Cd
need more samples, especially for > 50 m/s MBL winds

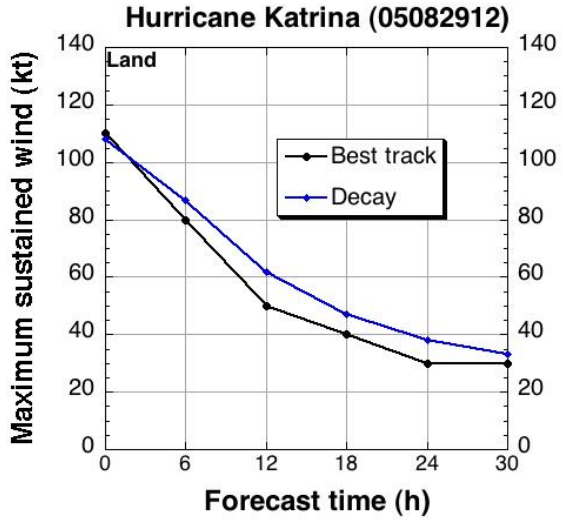
Ecosystem and Climate impacts

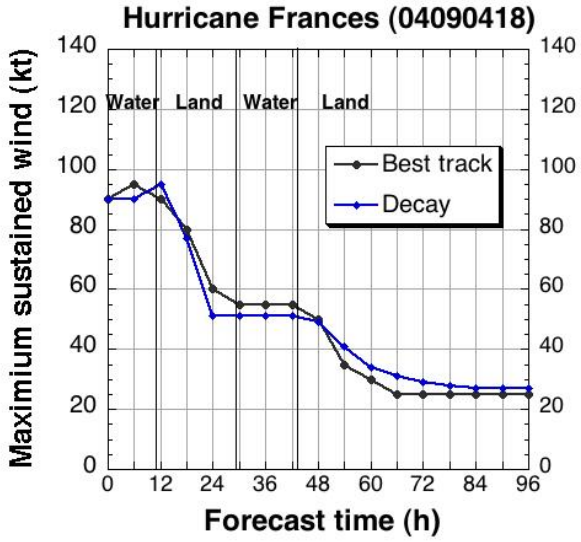
- Hurricane Katrina's carbon footprint (J. Chambers, Tulane)
- Endangered species movement during hurricanes (Langtimm USGS)
- Prediction of forest harvest loads (C. Collins, MSU)
- Sea turtle nesting patterns relative to hurricane landfall activity (K. Van Houtan, Emory)
- Chlorophyll enhancement in the Gulf of Mexico (N. Walker LSU)
- Forest disturbance (E. Boose Yale, W. Platt, LSU)
- Resource management of forested wetlands (E. Ramsay, USGS)

Inland winds

Accepted for transition by NHC

Utilize an inland decay model to provide real-time estimates of the maximum wind and wind radii based upon the official TPC forecast





Scientists: Kaplan, Dunion, Carrasco

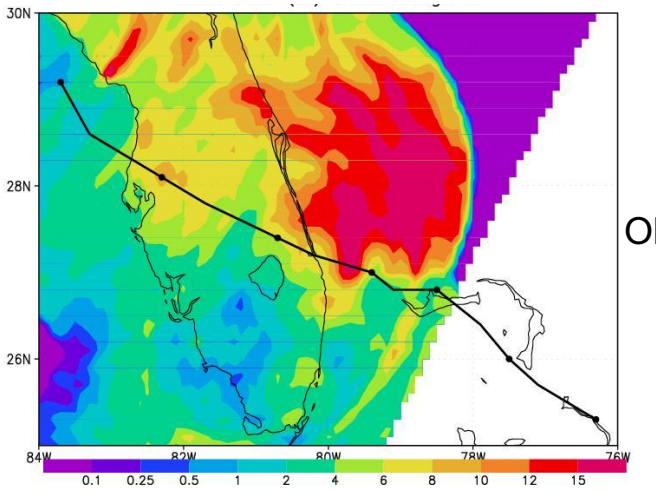
Rainfall flooding

Parametric Hurricane Rainfall Model (PHRaM)

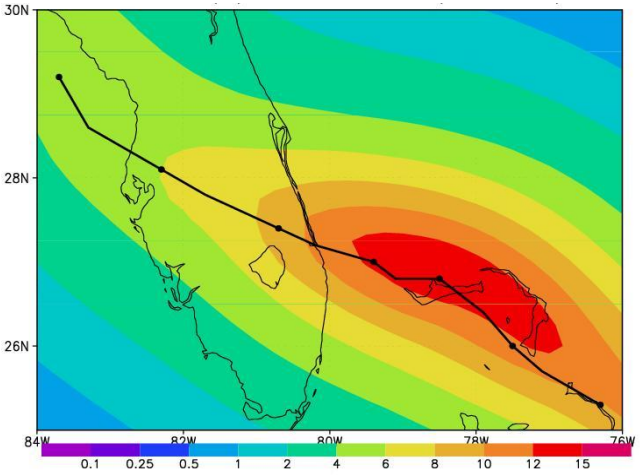
- Based on R-CLIPER
  - adds effect of vertical shear, terrain
- Can provide benchmark for verifying numerical model rainfall forecasts
- Successfully transitioned to operations via JHT

Scientists: Rogers, Marks, Valde

72-h rainfall (in) from Hurricane Frances (2004)



Observations



PHRaM

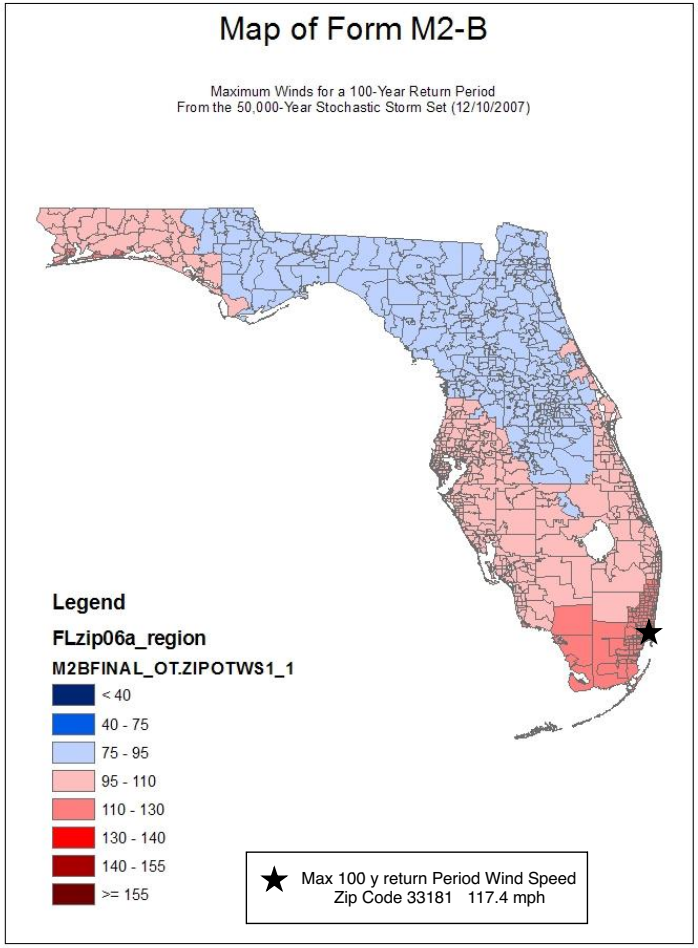
Risk Modeling

State of Florida Public Hurricane Loss Model

Thousands of years of hurricane activity modeled

Winds input to damage model and losses aggregated

Average annual loss computed at each zip code



Scientists: Powell, Annane, Dorst


QUESTIONS?

Background Material

Link to AOML-HRD Hurricane Impacts web page

http://www.aoml.noaa.gov/hrd/programs_sub/Hurricane_WindsLandfall.html